

and, in particular, from the passage on page 7, line 36 and page 8, line 1 (which states that the "effluent from the transalkylation reactor is blended with alkylation reactor effluent") that the present invention is concerned with a process in which the polyalkylated species produced as by-products from the alkylation step are fed to a separate transalkylation reactor rather than being recycled back to the alkylation reactor (see page 1, lines 18-20 of the present specification).

Claim 10 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as their invention. In particular, the Examiner correctly points out that "200 to 600 kPa" is not equivalent to "10 to 50 barg". It is clear from page 7, line 30 (which refers to a more limited range of 20 to 30 barg when the polyalkylated species is polyethylbenzenes) that the pressure range of "10 to 50 barg" is the range intended in Claim 10. Hence Claim 10 is now to be amended to remove the reference to kilopascals. A similar amendment is being made on page 7, line 25. It is therefore believed that the rejection under 35 U.S.C. § 112 is now fully met.

Claims 1-9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over EP 0733608 (the '608 reference) in view of U.S. Patent No. 5,557,024 (Cheng et al). This rejection is respectfully traversed and reconsideration is requested.

As defined by the amended Claims, the present invention is concerned with an alkylation/transalkylation process in which at least the transalkylation step is effected in the liquid phase in a separate transalkylation reactor. Thus, liquid phase alkylation/transalkylation processes are of increasing commercial importance since, by operating at lower temperatures, they result in lower yields of unwanted by-products. However, as stated in the opening to the specification, such liquid phase processes suffer from the problem that their lower operating temperatures increases the activity requirements of the catalyst particularly in the transalkylation step. According to the invention, it has now been found that small crystal (<0.5 micron), TEA-mordenite has

unexpectedly high activity when as a liquid phase transalkylation catalyst. In particular, small crystal TEA-mordenite exhibits unexpectedly higher activity as a liquid phase transalkylation catalyst than conventional TEA-mordenite (see Example 4 of the present application).

In contrast to the present invention, the '608 reference relates to an aromatics alkylation/transalkylation process which is conducted in the vapor phase (see page 2, line 19 and the conditions disclosed on page 3, lines 20 and 44) and in which the polyalkylated species is recycled to the alkylation reactor (see claim 1, lines 2 and 3). Although the Examiner refers to the statement on page 2, line 21 that the polyalkylated species in conventional alkylation/transalkylation process can be fed to a separate transalkylation reactor, it is clear from the ensuing disclosure on page 2, lines 21-31 that the invention in the '603 patent is concerned with a process in which the polyalkylated species is recycled to the alkylation reactor. Thus, according to page 2, lines 29-31, the discovery of the '608 reference is that the transalkylation activity of the alkylation catalyst (emphasis added) is enhanced if the alkylation catalyst has a crystal size of less than 0.5 micron. Apart from low crystal size, the only guidance the '608 reference gives as to the type of alkylation catalyst which exhibits increased transalkylation activity is ✓ that the catalyst should be an aluminosilicate with a Si/Al atomic ratio of 50 to 500 (see claim 1) and the aluminosilicate should have a primarily monoclinic structure (see page 3, line 21). No importance is attached in the '603 patent to the type of zeolite used as the alkylation/transalkylation catalyst and certainly there is no disclosure or suggestion in the reference of the use of small crystal TEA-mordenite as a separate transalkylation catalyst.

The Cheng et al reference discloses a process for producing alkylaromatic compounds in which an alkylatable aromatic compound is contacted with an alkylating agent in the presence of MCM-56 and the polyalkylated by-products are either recycled back to the alkylation reactor or fed to a separate transalkylation reactor (see column 14, lines 21-24). Where a separate transalkylation reactor is used, the Cheng et al reference teaches that the transalkylation catalyst can be MCM-49, MCM-22, PSH-3, SSZ-25,

zeolite X, zeolite Y, zeolite beta or mordenite (column 14, lines 27-30). In addition, Cheng et al state that suitable mordenite transalkylation catalysts are acid dealuminized mordenite and TEA mordenite as disclosed in U.S. Patent Nos. 3,766,093 and 3,894,104. Thus, insofar as Cheng et al teach the use of TEA-mordenite, it is as a separate transalkylation catalyst (combined with an MCM-56 alkylation catalyst) and as synthesized according to the disclosure of U.S. Patent Nos. 3,766,093 and 3,894,104. As shown by Examples 2 and 3 of the present application TEA-mordenite produced according to these earlier patents has a crystal size of >5 micron. Also, contrary to the indication on page 5, lines 3-8 of the Office Action, Cheng et al are silent as to the phase conditions of the transalkylation step, particularly where the transalkylation is performed in a separate reactor from the alkylation step.

To support a rejection of a claim for *prima facie* obviousness under 35 U.S.C. § 103, the U.S. Patent and Trademark Office bears the initial burden to establish three elements: (a) that all of the elements recited in the claim are found or suggested in the prior art as a whole; (b) that there is some motivation, teaching, or suggestion for modifying the prior art to arrive at the claimed invention; and (c) that there is a reasonable expectation of success when making the modification. See, for example, *The Manual of Patent Examining Procedure* ("M.P.E.P."), §§ 2142 through 2143.03. The teaching or suggestion to make the claimed modification and the reasonable expectation of success must both be found in the prior art, not in the patent applicant's disclosure. *Id.*, and *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q. 2d 1438 (Fed. Cir. 1991).

Viewed against this background, it is respectfully submitted that the Examiner has failed to establish a *prima facie* case of obviousness in view of the '608 reference either alone or in view of Cheng et al. Thus, given the fact that Cheng et al teach that the polyalkylated products can be recycled to the alkylation reactor, it is submitted that the only motivation to modify the references which would have a reasonable expectation of success would be to use MCM-56 with a crystal size of <0.5 micron as the alkylation/transalkylation catalyst in the vapor phase process of the '608 reference.

There is no motivation, teaching, or suggestion in the references to modify Cheng et al or the '608 reference such that a small crystal transalkylation catalyst is used in a process in which alkylation and transalkylation are performed in separate reactors. More particularly, there is a complete absence of any motivation, teaching, or suggestion to modify the references such as to select TEA-mordenite from the various zeolites taught by Cheng et al and then use the small crystal TEA-mordenite as the transalkylation catalyst in a process in which alkylation and transalkylation are performed in separate reactors. However, even such a modification of the references fails to meet the test for *prima facie* obviousness in that there is no disclosure in the references of a separate liquid phase transalkylation step. It is therefore respectfully submitted that the amended claims are patentably distinguished from the '608 patent and Cheng et al, both alone and in combination.

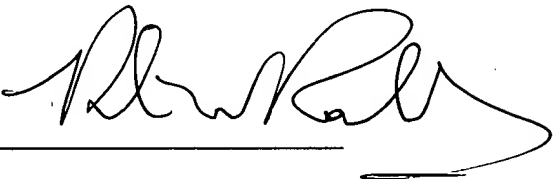
Claim 10 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the '608 reference and Cheng et al and further in view of U.S. Patent No. 4,891,458 (Innes et al). This rejection is respectfully traversed and reconsideration is requested.

Innes et al teaches a process for producing alkylaromatic compounds in which an aromatic compound is alkylated with a C₂-C₄ olefin in the presence of zeolite beta in an alkylation zone under at least partial liquid phase conditions and, after separation of the aromatic feed and the desired monoalkylated product, the polyalkylated fraction is contacted with additional aromatic compound in the presence of zeolite beta in a transalkylation zone under at least partial liquid phase conditions. Even assuming *arguendo* that it would be obvious to combine and modify the processes of the '608 reference and Cheng et al so as to adopt the teaching of Innes et al, since Cheng et al suggests the use of a zeolite beta as a transalkylation catalyst, it is respectfully submitted that such a combination would employ zeolite beta in the transalkylation reactor. It would be directly contrary to the teaching of Innes et al to effect such a combination in which small crystal TEA-mordenite is employed as the transalkylation catalyst. It is

therefore respectfully submitted that the amended claims are patentably distinguished from Innes et al, the '608 patent and Cheng et al, alone and in combination.

Applicants respectfully request entry of this Amendment because, for the reasons described above, this Amendment overcomes all of the outstanding rejections in this case and places the application in condition for immediate allowance.

Respectfully submitted,

By 

Peter W. Roberts
Reg. No. 31,702
Attorney for Applicants
(703) 281-3744

May 31, 2000

Peter W. Roberts
Roberts, Mlotkowski & Hobbes
3911 Old Lee Highway, Suite 43B
Fairfax, VA 22030